

REMARKS

This Amendment has been prepared in accordance with the revised amendment practice as set forth in revised 37 C.F.R §1.121 effective July 30, 2003. Reconsideration and allowance of the application are respectfully requested in light of the foregoing amendments and the following remarks.

Claims 1-57 have been examined.

Claims 5, 7, 9, 15, 20, 33, 38, 40, and 50 have been amended herein.

Claims 6, 36, 37, 46-49, and 53-57 have been cancelled.

Claim Objections

With reference to page 2 of the Office Action, the Examiner had objected to Claims 41-43 on formal grounds such that the word "transmitter" in line 1 of Claim 41 must be changed to the word "transmitting" in order to provide proper antecedent basis. For consistency, Applicant has changed the word "transmitting" to "transmitter" in line 4 of the claim (i.e., Claim 40) from which Claim 41 depends. Accordingly, there is now proper antecedent basis for the term "second transmitter means" in Claim 41; and, therefore, the Examiner's objection has been traversed.

Claim Rejections Under 35 U.S.C. §102 and §103

Claims 1-8, 10, 11, 15, 19-22, 25, 33, 38-41, 44, 45, and 53-56 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 3,267,416 to Morse (the "Morse '416 Patent").

Claims 9, 12-14, 16-18, 23-24, 26-32, 34-37, 42-43, 46-52 and 57 have been rejected under 35 U.S.C. §103(a) as being obvious in view of the Morse '416 Patent and further in view of the publication titled "Nonlinear Acoustic Non-destructive Testing of Cracks" by Sutin (hereinafter "the Sutin 1 Publication").

Claims 1-57 have been rejected under 35 U.S.C. §102(a) or §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being obvious in view of either the publication titled "A Nonlinear Acoustic Technique For Crack and Corrosion Detection In Reinforced Concrete" by Donskoy et al. (hereinafter "the Donskoy Publication"), or the publication titled "Nonlinear Acoustic Non-destructive Testing of Cracks" by Sutin (hereinafter "the Sutin 2 Publication"), or the publication titled "Nonlinear Acoustic Methods for Crack and Fatigue Detection" by Sutin et al. (hereinafter "the Sutin 3 Publication"), or the publication titled "Variations of Acoustic Nonlinear Parameters With the Concentration of Defects in Steel" by Korotkov et al. (hereinafter "the Korotov 1 Publication"), or the publication titled "Modulation Of Ultrasound By Vibration In Metal Constructions With Cracks" by Korotkov et al. (hereinafter "the Korotov 2 Publication"). For the reasons that follow, these rejections are respectfully traversed.

The Morse '416 Patent discloses a system for detecting the presence and thickness of ice on the surface of a body of **liquid** water as an aid to navigation for submarines under the ice cover of the Arctic regions. The system applies a low frequency sonar signal and high frequency sonar signal to the body of **liquid** water and thenceforth to the underside of any ice pack which may lie on top of the surface of the body of water. The high frequency signal is reflected from the underside of the ice at

the ice-water interface. The low frequency signal passes through the ice-water boundary, passes through the ice, and is reflected at the ice-to-air interface. The reflections from the low and high frequency signals are then detected at transducers, separated by filter circuits, and recorded on a strip chart. The differences in the time of receiving the low frequency and high frequency signals are indicative of the thickness of the ice pack on the surface of the water (see col. 1 lines 49-67 and col. 2, lines 68-72 of the Morse '416 Patent). The low frequency signal does not interact with the high frequency signal. Hence, there is **no modulation of the high frequency signal by the low frequency signal** to detect the presence or location of ice, whether it be on a liquid body of water (as disclosed in the Morse '416 Patent) or on a **solid** structure.

The non-patent publications cited by the Examiner refer to methods and systems for detecting defects or cracks **within** a structure using a high frequency signal that is modulated by a low frequency signal. The **low frequency signal is applied** to the structure by an **external device**, such as a piezoelectric transducer, a hammer, or a shaker. None of the cited publications disclose detecting the presence or location of ice, which is an external object that is **not inherently part of the structure**. Nor do any of the referenced publications disclose detecting the **location** of a defect in a structure.

There is no motivation to combine the Morse '416 Patent with any of the foregoing non-patent publications because the low and high frequency signals disclosed in the Morse '416 Patent do not interact with each other, and certainly not in a modulating fashion. On the contrary, the foregoing publications disclose devices which apply low and high frequency signals which interact with each other within a structure in a modulating fashion.

Pending independent Claim 1 is directed to an apparatus for detecting the presence of ice on a structure, in which a received signal is produced by the **modulation** of a high frequency signal by a low frequency signal responsive to the presence of ice on the structure. The Morse '416 Patent does not disclose or suggest receiving a modulated signal. The Sutin 1 Publication does not disclose or suggest detecting the presence of **ice on (i.e., external to)** a structure, nor can the Sutin 1 Publication be combined with the Morse '416 Patent because the low and high frequency signals disclosed in the Morse '416 Patent do not interact with (i.e., modulate) one other. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests detecting the presence of **ice on (i.e., external to)** a structure.

Accordingly, Applicant respectfully submits that the apparatus for detecting the presence of ice on a structure recited in pending independent Claim 1 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the non-patent publications. Applicant further submits that since pending independent Claim 1 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 2, 22, 23, and 24) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Independent Claim 3 recites a method implemented by the operation of the apparatus of independent Claim 1. Since pending independent Claim 3 recites steps equivalent to those that patentably distinguish the apparatus of pending independent Claim 1 from the systems disclosed in the Morse '416 Patent and the non-patent

publications, then it should follow that pending independent Claim 3 also patentably distinguishes over the cited prior art. That is, the Morse '416 Patent does not disclose or suggest receiving a modulated signal. Also, the Sutin 1 Publication does not disclose or suggest detecting the presence of **ice on (i.e., external to)** a structure, nor can the Sutin 1 patent be combined with the Morse '416 Patent because the low and high frequency signals disclosed in the Morse '416 Patent do not interact with (i.e. modulate) one other. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests detecting the presence of **ice on (i.e., external to)** a structure. Applicant respectfully submits that since pending independent Claim 3 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 4, and 25-32) should distinguish over such prior art for the same reasons.

Independent Claim 5, as amended, recites steps similar to pending independent Claim 3, except that the modulations of the high frequency probe signal by a low frequency signal are analyzed rather than being merely received. Since amended Claim 5 recites steps equivalent to those that patentably distinguish the method of pending Claim 3 from the methods disclosed in the Morse '416 Patent and the non-patent publications, then it should follow that amended independent Claim 5 also patentably distinguishes over the cited prior art. Applicant respectfully submits that since amended independent Claim 5 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 7-9) should distinguish over such prior art for the same reasons.

Pending independent Claim 10 recites a method for detecting the **location** of defects in or ice on a structure which includes the step of **propagating sequences** of an ultrasonic probe signal in a structure. Neither the Morse '416 Patent nor the Sutin 1 Publication discloses or suggests propagating sequences of an ultrasonic probe signal. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests the step of **propagating sequences** of an ultrasonic probe signal in a structure.

Accordingly, Applicant respectfully submits that the method for detecting the location of defects in or ice on a structure recited in pending independent Claim 10 is patentably distinguishable from the methods disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since pending independent Claim 10 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 11 and 12) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Pending independent Claim 13 recites an apparatus for non-destructive testing of a structure which includes control means for transmitting a low frequency signal and an ultrasonic signal into the structure in which the high frequency signal has a repetition frequency which is greater than twice the frequency of the low frequency signal. Neither the Morse '416 Patent nor the Sutin 1 Publication discloses or suggests transmitting repetitive sequences of an ultrasonic probe signal. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests transmitting repetitive sequences of an ultrasonic probe signal.

Accordingly, Applicant respectfully submits that the apparatus for non-destructive testing of a structure recited in pending independent Claim 13 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since pending independent Claim 13 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claim 14) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Independent Claim 15, as amended, recites an apparatus for determining the location and characteristics of defects in or ice on a structure which includes means for receiving a modulated signal from the structure caused by the low frequency signal modulating the high frequency signal in response to **the location of** a defect in or ice on the structure. The Morse '416 Patent discloses a system for detecting the thickness of the ice, but not the location of the ice on a structure, nor does the Morse '416 Patent disclose the ice-structure boundary causing the low frequency signal to modulate the high frequency signal. The Sutin 1 Publication does not disclose or suggest determining the location of ice on or a defect in the structure. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests determining the location of the ice on or defect in the structure.

Accordingly, Applicant respectfully submits that the apparatus for determining the location and characteristics of defects in or ice on a structure recited in amended independent Claim 15 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since amended independent Claim 15 is believed to patentably distinguish over the

cited prior art, then all of the claims depending therefrom (i.e., Claims 16-18 and 20) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Pending independent Claim 19 recites an apparatus for quantitatively analyzing defects in a structure which includes means for receiving frequency modulated signals from the structure caused by **a low frequency signal modulating a high frequency signal** in response to a defect in the structure, and means connected to said receiving means for measuring, averaging and normalizing the amplitudes of side bands in the received modulated signals to generate an indication of the **size** of a defect in the structure. The Morse '416 Patent discloses a system for detecting the **thickness** of the ice, but does not even relate to the detection of defects in a structure, nor does it disclose or suggest modulating a high frequency signal by a low frequency signal. Furthermore, the Sutin 1 Publication does not disclose or suggest determining the **size** of a defect in a structure. Thus, the Sutin 1 Publication cannot be combined with the Morse '416 Patent because the low and high frequency signals disclosed in the Morse '416 Patent do not interact with (i.e. modulate) each other. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests determining the **size** of a defect in a structure.

Accordingly, Applicant respectfully submits that the apparatus for quantitatively analyzing defects in a structure recited in pending independent Claim 19 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the cited non-patent publications. The withdrawal of the rejection is, therefore, respectfully requested.

Pending independent Claim 21 recites an apparatus for detecting the **location** of defects in a structure which includes the step of **generating sequences of a short burst high frequency** signal in the structure. Neither the Morse '416 Patent nor the Sutin 1 Publication discloses or suggests generating sequences of a short burst high frequency signal. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests generating sequences of a short burst high frequency signal.

Accordingly, Applicant respectfully submits that the apparatus for detecting the location of defects in a structure recited in pending independent Claim 21 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since pending independent Claim 21 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claim 39) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Independent Claim 33, as amended, recites a method for quantitatively analyzing defects in a structure which includes the steps of **sweeping the high frequency** signal over a frequency range, and receiving modulated signals from the structure caused by a **low frequency signal modulating a high frequency signal** in response to a defect in the structure, and analyzing side bands in the received modulated signals. The Morse '416 Patent discloses a method of detecting the **thickness** of the ice, but it does not disclose **sweeping the frequency of the high frequency signal**, nor does it disclose the ice-structure boundary causing the low frequency signal to **modulate** the high frequency signal. In addition, the Sutin 1 Publication does not disclose or suggest

determining the **size** of a defect in a structure. Thus, the Sutin 1 Publication cannot be combined with the Morse '416 Patent because the low and high frequency signals disclosed in the Morse '416 Patent do not interact with (i.e. modulate) each other. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests analyzing defects including the step of **sweeping the frequency of the high frequency signal**.

Accordingly, Applicant respectfully submits that the method for quantitatively analyzing defects in a structure recited in amended independent Claim 33 is patentably distinguishable from the methods disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since pending independent Claim 33 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 34 and 35) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Pending independent Claim 38 recites a method for detecting the **location** of defects in a structure which includes the step of **generating sequences of a short burst high frequency signal** in the structure. Neither the Morse '416 Patent nor the Sutin 1 Publication discloses or suggests propagating sequences of a short burst high frequency signal. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests generating sequences of a short burst high frequency signal.

Accordingly, Applicant respectfully submits that the method for detecting the location of defects in a structure recited in pending independent Claim 38 is patentably

distinguishable from the methods disclosed in the Morse '416 Patent and the cited non-patent publications. The withdrawal of the rejection is, therefore, respectfully requested.

Independent Claim 40 recites an apparatus for detecting the presence of a defect in a structure which includes trigger means for triggering the transmission of said high frequency probe signal **after** the transmission of said low frequency signal. The Morse '416 Patent does not disclose or suggest triggering the high frequency signal only **after** the low frequency signal has been transmitted. In fact, the Morse '416 Patent discloses **simultaneous** transmission of the low and high frequency signals (see col. 2, lines 12-13). In addition, the Sutin 1 Publication does not disclose or suggest triggering the high frequency signal after the low frequency signal has been transmitted. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests triggering the high frequency signal only after the low frequency signal has been transmitted. In fact, the Korotov 1 Publication discloses **simultaneous** transmission of the low and high frequency signals (see col. 1, paragraph 3 thereof).

Accordingly, Applicant respectfully submits that the apparatus for detecting the presence of a defect in a normally vibrating structure recited in amended independent Claim 40 is patentably distinguishable from the systems disclosed in the Morse '416 Patent and the cited non-patent publications. Applicant respectfully submits that since amended independent Claim 40 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 41-43) should distinguish over such prior art for the same reasons. The withdrawal of the rejection is, therefore, respectfully requested.

Finally, pending independent Claim 44 recites a method implemented by the operation of the apparatus recited in amended independent Claim 40. Since pending independent Claim 44 recites steps equivalent to those that patentably distinguish the apparatus of amended independent Claim 40 from the systems disclosed in the Morse '416 Patent and the non-patent publications, then it follows that amended independent Claim 44 also patentably distinguishes over the cited prior art. That is, the Morse '416 Patent does not disclose or suggest triggering the high frequency signal only **after** the low frequency signal has been transmitted. In fact, the Morse '416 Patent discloses **simultaneous** transmission of the low and high frequency signals (see col. 2, lines 12-13 thereof). In addition, the Sutin 1 Publication does not disclose or suggest triggering the high frequency signal only after the low frequency signal has been transmitted. Furthermore, none of the remaining cited non-patent publications alone or in combination discloses or suggests triggering the high frequency signal only after the low frequency signal has been transmitted. In fact, the Korotov 1 Publication discloses **simultaneous** transmission of the low and high frequency signals (see col. 1, paragraph 3 thereof). Applicant respectfully submits that the method recited in Claim 44 is patentably distinguishable from the system disclosed in the Morse '416 Patent and the cited non-patent publication. Applicant also submits that since pending independent Claim 44 is believed to patentably distinguish over the cited prior art, then all of the claims depending therefrom (i.e., Claims 45 and 50-52) should distinguish over such prior art for the same reasons.

In view of the foregoing amendments and remarks, Applicant respectfully requests reexamination and allowance of Claims 1-5, 7-35, 38-45, and 50-52. If such

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action cannot be taken, then the Examiner is invited to contact the Applicant's attorney at the telephone number set forth below to discuss the matter without the issuance of a further Office Action.

Also enclosed herewith is a petition for a three (3) month extension of time to submit this Amendment to and including September 9, 2005, for which a \$510 fee is due. The Petition authorizes the Examiner to charge this \$510 extension fee to Deposit Account No. 50-3571.

No additional fees are believed to be due as a result of this Amendment. Should there be any fees due as a result of the filing of this Amendment, including, without limitation, extension and/or petition fees, then the Examiner is hereby authorized to charge them to Deposit Account No. 50-3571.

Respectfully Submitted,

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